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Taking a Closer Look at Uncertainty in IS projects

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ABSTRACT

Uncertainty is a part of any IS project. When developing something new and previously untried there must be uncertainty. In the literature, however, uncertainty is often mixed with risk and treated solely through risk management. We decided to take a closer look at uncertainty. Based on in-depth analysis of qualitative interviews with experienced IS project managers we identify four different types of uncertainty, which we call Task uncertainty, Collaborative uncertainty, Process uncertainty, and Individual uncertainty. We also derive project management coping strategies for dealing with each of the four kinds of uncertainty.

Keywords

Uncertainty, project management, task, collaboration, process.

INTRODUCTION

Studies have shown that IS developers adapt and apply elements from IS project development methodologies in a pragmatic way (Bansler & Bødker, 1993; Stolterman, 1992; Fitzgerald, 1997; Vidgen, 2002), and that IS development in practice is locally situated, historically contingent, and somewhat ‘messy’ social action that unfolds over time in an only partly predictable way.

The ‘messiness’ include issues such as communication breakdowns; resistance to change; unclear goals; changing system requirements; conflicting stakeholder demands; individual career concerns; difficulties in achieving time with and information from future end users; time- and budget constraints; pressure to deliver results; rapid technological change in the market place; other planned and unplanned organizational changes; and difficult and unexpected technical problems at the project level, e.g. with regard to software design and system integration (Wastell & Newman, 1993; Gasson, 2005).

Risk management has become established as a core project management discipline for identifying, assessing, and taking action to avoid or reduce risks that can threaten project success (Boehm, 1991; Duncan, 2000; Hall, 1998; Keil et al., 1998; Raz & Michael, 2001; Schmidt et al., 2001). However, the terms, risk and risk management, have been criticized for being too narrowly focused on unfavorable events and probabilities, thereby overlooking opportunities as well as more general sources of uncertainty, such as human nature, action, and interaction (Pender, 2001; Ward & Chapman, 2003).

It seems that the ability to deal effectively with change as an individual or as a group of individuals in uncertain situations – where the uncertainty can stem from many different sources at the same time – is an important skill in IS projects. Mathiassen & Stage (1992) suggest that if “we want to deal with uncertainty we have to understand how human beings behave in the face of uncertainty” (pp. 169). However, so far, only little research has explored the relationship between causes, perceived level of uncertainty, and individual and group behavior at different stages of the development process (Madsen, 2007).

In this paper we set out to study uncertainty in IS projects by probing into project managers’ experience of and view on the phenomenon. The study is structured around the following research questions: what is uncertainty?, what creates uncertainty?, and how do you manage uncertainty – individually and in a project group?. The aim is to contribute to the field of IS project management with a framework about uncertainty, which is firmly grounded in empirical data.

WHAT WE KNOW ABOUT UNCERTAINTY

A literature survey revealed that even though uncertainty is widely mentioned as a fundamental characteristic of IS projects little research attention has been paid to the concept of uncertainty as such. However, we did identify a number of definitions.

In addition, we found that three different perspectives (inspired by Markus & Robey 1988; Slappendel 1996) could be used to describe and derive an understanding of uncertainty from the existing literature.

Defining uncertainty

Mathiassen & Stage (1992, pp. 162) apply an information perspective and state that “the degree of uncertainty represents the availability and reliability of the information that is relevant in a given situation”, while uncertainty according to the Oxford dictionary (see e.g. AskOxford.com) is about ‘a state of being’ or (not) knowing. The definitions point out that decision makers are always only working with part of the picture, that there is always information missing, and that there therefore are lots of things that practitioners do not and could not know when they make judgments and decisions about the appropriate course of action and its outcome (Streatfield, 2001). Based on the literature we understand the concept of uncertainty as: ‘the individual’s and/or group of individuals’ perceived level of not knowing the appropriate course of action and/or its outcome at a given point in time’.

A structuralistic perspective

The structuralist perspective focuses on structural and situational causes of uncertainty. The perspective addresses the question of what the major situational causes of uncertainty are. In the introduction section of this paper a long list of often mentioned causes of uncertainty was for example outlined, which can be summarized as the following higher level concepts: context, product under development, individuals, complexity, information scarcity, unexpected events, and structural mechanisms (Davis, 1982; Mathiassen & Stage, 1992; Sabherwal, 1999). It is assumed that for each of these concepts there are characteristics that in- or decrease the uncertainty of the IS project, i.e., too few structural mechanisms might increase the perceived level of uncertainty.

An individualistic perspective

The individualist perspective addresses the question of how uncertainty influences the individual. A key observation here is that individuals are different. A number of approaches exist to characterize these differences. One example is Belbin’s (1985) team role model where he derive and describe nine distinct and interdependent team roles based on a study of successful and unsuccessful teams. Another example is Adizes’ (1979) management roles where the claim is that effective management requires you to bring a team of leaders together with four key elements represented so as to be able to handle the most complex and dynamic issues. A third example is the Drexler et al. (1988) team model that describes a number of phases that a project team goes through. Finally there is the Myers-Briggs Type Indicator (MBTI) that can be used as a foundation for understanding individual preferences (Bayne, 1997; Myers, 1980; Quenk, 2000):

With regard to behavior, the literature describes that in critical, high uncertainty situations individuals may create a distorted perception of reality as they become unable to concentrate, develop a tendency to over-generalize and in general lose their objectivity and sense of proportion (Wastell & Newman, 1993). In comparison, when the level of uncertainty is appropriate the individual is able to concentrate in the moment, and on all the available and relevant information and to engage in reflective (Schön, 1983), and participative conversations (Streatfield, 2001) to make sense of the situation and formulate intentions for future action.

A social process perspective

The social process perspective addresses the question of how uncertainty influences the individuals in the group and as a group over time. The literature suggests that when the level of uncertainty is too high the project group is likely to engage in competitive rivalry and/or groupthink, where groupthink refers to the anxiety and stress-reducing “psychological drive for consensus at any cost” (Janis, 1982). In comparison, when the level of uncertainty is appropriate the group is likely to engage in collaborative critical inquiry and evaluation of alternatives and to co-operates in the pursuit of task. Interestingly, the behavior described at the individual and group level is very similar, which suggests that more research is needed, that it is difficult to distinguish between individual and social action (as all action already to some extent is manifested *in* the world, and therefore is social), or both.

RESEARCH METHOD

We decided to undertake an empirical study of IS project managers. Concretely we found an executive master-level course for experienced project managers at a University that we could center our study around. The course was called “Advanced IS Project Management”. It ran over half a year in the fall of 2007 and again in the fall of 2008. The participants were IS project managers with at least three years working experience. One of the authors’ of this paper was the teacher responsible for the

course. The participants meet every three weeks for classroom teaching. In between the teaching sessions that took place on Saturdays the participants worked on a project in a team of 5-7 people. During the fall of 2007 and 2008 the two times four project groups worked in and outside of class, where they use the presented IS project management techniques and models to jointly reflect on their practice through case examples that they selected from their own experience. This reflection was documented in the form of a 50 page project report delivered at the end of the course and evaluated in an oral exam in January 2008 and again in January 2009.

We selected the setting around this course - Advanced IS Project Management - as a highly relevant setting for a study of uncertainty in IS projects, because a) the course participants were professional project managers that b) worked together and shared the experience of performing a group project, c) in which they reflected on the nature and management of IS projects.

Our empirical data consists of 7 plus 9 semi-structured interviews (conducted in January 2008 and January 2009 respectively), seven project reports, and the course teacher's observations in the form of written notes and anecdotal episodes from memory. For the interviews we used the three perspectives (described in the literature section above) to develop a semi-structured interview guide that was organized around a focus on the concept, causes, and individual and group management of uncertainty in the project work performed as a part of the Advanced IS Project Management course. This created a shared point of reference across the interviews. Each interview lasted approx. 1 hour, was tape-recorded, and later transcribed. The interviews took place in the interim between the project reports were delivered late December and the oral exams in January (2008 as well as 2009). To avoid any bias issues from the teacher-student relationship or from the upcoming oral exam the author who was teaching the course did not participate in the interviews. Instead they were performed by the other author of this paper, i.e., by an 'outside' researcher (Walsham, 1995). In Table 1 we show an overview of seven interviewees that we cite as well as their experience and background.

Interviewees	Background
A	42 years. IT Consultant specializing in document handling projects. Before that Bachelor in Chemistry and 5 ½ years of practical experience from that field.
B	34 years. Two years of experience as project manager in IT projects aimed at public schools and institutions. Before that Bachelor in and practical experience with teaching in public school.
C	48 years. Master in IT and Russian from 20 years ago, have worked with IT testing and project management in relation hereto since.
D	43 years. Master in Computer Science. Works as IT Consultant and Project Manager in projects for customers. Main focus on process improvement and testing.
E	35 years. Combined project and line manager in a smaller company. Focus on processes and improvement.
F	25 years. Works with IT in an insurance company. Mainly systems administration.
G	28 years. Diploma in Multi Media design and Bachelor in Business Administration. Works in internet software house. Responsible for 5-6 people developing front end.

Table 1: Interviewees cited in the paper

Data analysis has been carried out in accordance with the main guidelines for thematic coding of qualitative data (Kvale, 1996; Creswell, 2003). First, each paper author read the interview transcriptions, project reports, and observation notes, and identified potentially relevant themes. During this step, one author used the definition and perspectives from the literature study as a guide for coding, while the other author primarily looked for inductive and emerging themes. The individually identified themes were subsequently discussed in a meeting, and based on this we developed a shared understanding, wrote a list of main and sub themes, and took notes for the later write-up of this paper. To ensure internal validation we have chosen a division of process and perspective during both data collection and analysis.

IDENTIFYING FOUR TYPES OF UNCERTAINTY

The result of our literature study was that uncertainty could be defined as one concept that could be seen from the *structuralist*, the *individualist*, and the *social process* perspective. This understanding was used to guide our data collection. However, already in the first round of empirical data analysis we found a number of observations that did not fit well with this conceptual understanding. I.e., the initial definition of uncertainty was not comprehensive enough to catch the nuances of the data material. Further data analysis led us to view uncertainty not as one concept, but as four different types of uncertainty, namely Task, Collaborative, Process, and Individual uncertainty.

Task uncertainty

Task uncertainty addresses the uncertainty that arises due to a lack of understanding of or doubts about the project, its end result, as well as major and minor tasks within the project. The interview participants explain that uncertainty increases when you do not know: *"how to perform a task...when you don't know what, how, and when"* (C). The difference between being certain and uncertain is described in the following way: *"If you are certain...then you know what the next action has to be and what to say and do...when you are uncertain then you just muddle through...[and you] act different than normal...it can be for a shorter or longer period of time. It can be just one question that you are uncertain about and go a bit back and forward on and then becomes certain."* (E).

It is further explained that when task uncertainty is high then *"you use a lot of energy to, all the time, stay attentive to the direction in which things are moving"* (B) and when it becomes too high *"[then] you can tell from the way people look... 'we won't make it'...and the eyes are moving rapidly...very much about body language. And...now we have to get all the 'to-do' activities down on paper and we have to set the dates and get the tasks distributed"* (D). Thus, task uncertainty requires a lot of energy and attention and too much uncertainty might lead to a state of stress or panic. One way of dealing with a high level of task uncertainty is to try to get back in control via project planning, lists, and templates *"...because when you have that list then the uncertainty is gone."* (C). It is important to *"understand the big picture. Where are we going? What is the goal? What are we supposed to end up with? And then you can split it up afterwards and say... what do I have to do today and tomorrow then."* (A). However, it is also recognized that planning and the introduction of structure as a coping mechanism is not unproblematic because *"then you are also planning the result."* (B).

Task uncertainty does not only concern a lack of knowledge or overview over what, how, and when. It also has to do with doubts about one's own abilities and tasks, the time frame, as well as the quality of the end result. In other words, it is about *"... whether you are good enough for the task"* (G), *"what the person is supposed to do, what is expected, can we make it in time"* (G) and *"if it is good enough"* (F). To understand expectations and to deal with doubt the IS project managers explain that they seek out information and confirmation from peers and superiors by asking questions and engaging in reflective, and participative conversations, including (in)formal reviews. The use of reviews as a relevant technique for dealing with task uncertainty is confirmed by the project reports, where the value is explained, but it is also related that the reviews created additional doubt about some aspects of the project groups' work and way of working - as well as a general sense of being on the right track. The course teacher also remembers that one course participant became so frustrated with the review that he decided to leave the course. This illustrates characteristics of the review technique, but more importantly it points out that project participants need to believe in the project and to do so, they need feedback and reassurance from others.

Collaborative uncertainty

Collaborative uncertainty addresses the uncertainty that arises due to (a lack of knowledge about) the individuals in the group, and their different expectations, preferences, abilities, and actions. All the interviewed project managers explain that there always is some collaborative uncertainty in the beginning of a project because of new or uncertain social ties and because they do not yet know what to expect with regard to the different group members' interest in and ability to participate and deliver. Particularly the importance of being able to count on people to participate and deliver as promised is stressed during the interviews and also illustrated in the following quotes. *"Who is committed and who is not committed...that time period where you have to figure out who people are...what they can contribute with and what their competences are."* (B). *"I have to see that there is value for money. It is not enough that there is a plan...if you don't sense that people will follow the plan and you sense that the deliverables do not arrive quite as you expect."* (A).

It is also explained that collaborative uncertainty increases *"if people start to...behave irrational, make unreasonable demands and if the tone really increases then...you become uncertain about how it will work out."* (G); if it is unclear *"what my role is precisely?"* (A) and *"when you do not get the information you need"* (C). However, *"the biggest stress factor of all is conflicts...conflicts with colleagues or with project managers. That is a lot more stressful than all other things. A bad working climate in general...that is stressful...I'm not saying that all stress is gone if the working climate is good. But a good*

climate makes it possible to deal with all the other things." (C). In general, the project managers agree that it is extremely important to feel comfortable in the group.

Collaborative uncertainty is managed in several ways. First, the level of participation and communication is either deliberately increased to deal with uncertainty or it is, more or less unconsciously, decreased as group members withdraw for a while until they feel more in control and ready to engage again. Second, collaborative uncertainty is dealt with through expectation management as well as formal and informal distribution of roles. In the Advanced IS Project Management course the participants were asked to form groups and write a "social contract". The interview participants explain that the process of making the social contract was very useful because it facilitated collaborative adjustment and expression of expectations. However, once the project work had commenced the content of the social contract, and especially the formally assigned roles, were somewhat 'forgotten' and instead a more informal work and role structure was allowed to emerge. Third, a strategy for managing the group's level of perceived uncertainty is to deliberately force oneself to feel and act 'as-if' one is calm and in control (i.e. by doing deep acting, Hochschild, 2003), while another less productive, and 'unmanaged' reaction to uncertainty is to go into a state of panic. Panic can be disastrous, because it can spread to the entire group and because it makes it virtually impossible for the individual and the group as a whole to think straight and act sensibly.

Process uncertainty

Process uncertainty arises at different points in time during the IS development process, namely in the beginning, middle, and when deliverables have to be handed in along the process or in the end. Based on the empirical data we coin these sub categories: 'start-up uncertainty', 'midway crisis', and 'deliverable-uncertainty'.

Start-up uncertainty. The project managers explain that there will always be some start-up uncertainty, because nothing is settled; because of the group formation process and the initial period of time where you have to get to know each other and each others' competences, and level of commitment; and because of uncertainty about "*well, what are we supposed to do*" (D). Start-up uncertainty is managed by scoping the project so it has a solid 'foundation' to start from with regard to content and process and by using other project management techniques, such as a social contract, project planning, distribution of roles and tasks, etc. Only the collaborative aspect was not managed in a direct sense. "*...here we didn't do anything and it [the Collaborative uncertainty] also went away by itself when I discovered that it was a group I worked really well with.*" (F).

Midway crisis. The midway crisis was described as a time period where the project members experienced a dip in energy, enthusiasm, and focus; had doubts about the project and the quality of the work; and where unexpected events, such as private issues, overlooked tasks, and the re-negotiation of the initially outlined foundation for the project influenced the group's ability to perform. One of the project managers explains that "*there was a point where I thought that it went really, really bad*" (A) and another states that "*...around the middle you also have doubts about whether you are heading in the right direction, and you get into some really...actually really silly discussions where you feel uncertain about if everything is wrong.*" (F). When asked if the midway crisis occurs as a pattern in most projects, the interviewees agreed, but "*...you still get surprised every time. And, well, I don't take any precautions...*". The midway crisis just happens and "*...is caused by a number of things that are unrelated.*" (D). The teams got through the period of doubt and loss of momentum via reviews and feedback from others, while the unexpected events were dealt with via re-negotiation of the project's content, the project plan, and the distribution of tasks.

Deliverable-uncertainty. Whereas start-up uncertainty arises because of collaborative aspects as well as task uncertainty, deliverable-uncertainty arises because of doubts about the quality of the deliverable and the time frame, i.e., about "*will we make it in time?*" (D). It is explained that "*when we got close to the deadline [the uncertainty was] the highest, definitely.*" (G) and that "*here [in the end] we focus on reaching the goal and then we also make it... we did a lot work in a very short time...just before the deadline*" (D). Thus, deliverable-uncertainty is managed via focus and lots of work.

Individual uncertainty

Individual uncertainty concerns the individual experience of task, collaborative, and process uncertainty and the reaction to or 'management' of that experience. Thus, when the level of task, collaborative, and process uncertainty increases the level of individual uncertainty is also likely to increase. The experience and way of coping is specific to the individual, but it may to some extent be explained via the person's psychological type. The interview participants describe the concept of 'individual uncertainty' in the following way. "*.. it is very different how people experience it. If people like uncertainty and feel comfortable with it.*" (B); "*And there were some who... yes, panicked a bit and said that now we have to get this under control because otherwise we can't deal with it. Where I personally felt that well, yes, we just deal with it. I think that we have been very, very individual in that respect.*" (D); "*And someone like [another personality profile] thinks that it is great,*

it is fantastic, everything will work out. Where the rest of us feel less confident and want to hide somewhere or run away.” (E).

Data analysis shows that individual uncertainty and the management here of is best understood as a continuum *from* high to low, *from* feeling uncomfortable to comfortable, tense to relaxed, *from* panicking to staying calm, *from* focusing on the details *or* the bigger picture. In this continuum the Myers-Briggs personality profile called the ‘organizer’ - seems to be a profile that experiences quite some uncertainty, which might lead to some reduction in overall job performance and cognitive capacity but only if it is not managed through temporarily social withdrawal, reflection on one’s own profile and actions, and detailed project planning. The ‘problem solver’ seems to be the Myers-Briggs profile that experiences the least uncertainty, and who is able to concentrate and focus on understanding and intention formulation in most circumstances.

DISCUSSION AND CONCLUSION

In this paper we report from a qualitative study of IS project managers’ answers to the questions of what uncertainty is?, what creates uncertainty?, and how you can manage uncertainty – individually and in a group?. A key insight is that uncertainty is always perceived as uncertainty-about-something. We also found that uncertainty has to be seen as several different types of uncertainty with different and distinct causes and coping strategies. Below, we summarize our more detailed research findings in the form of a framework (see Figure 1). The framework outlines the four types of uncertainty as well as the identified causes and management (coping) strategies.

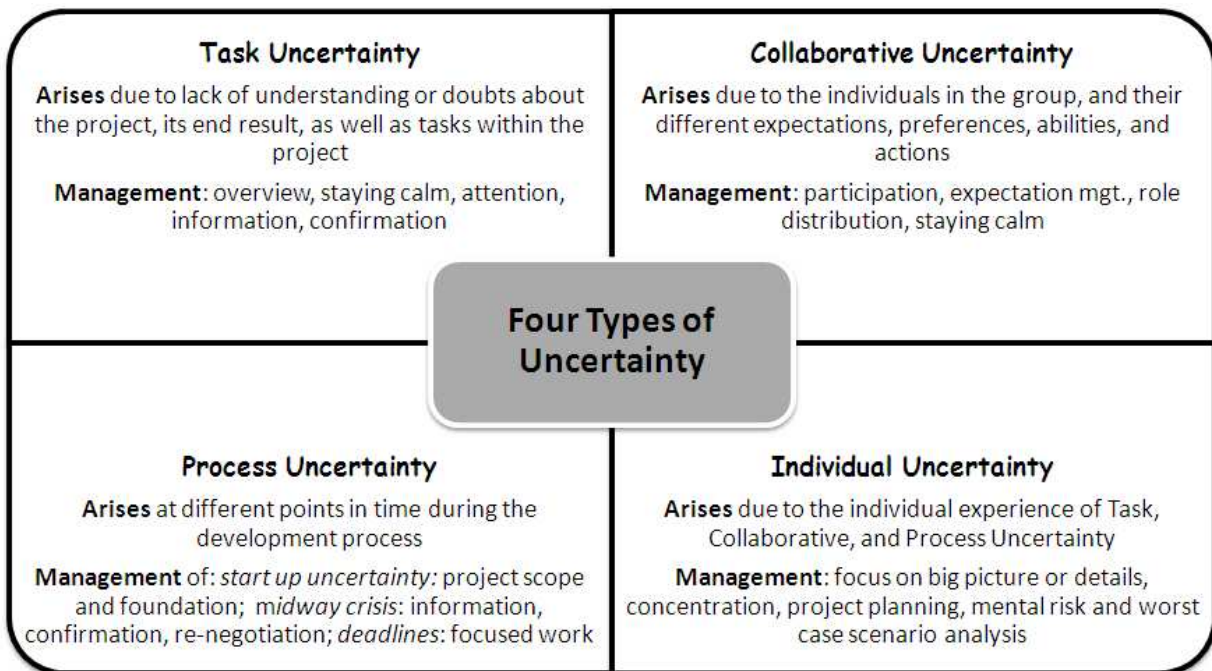


Figure 1. Framework of uncertainty

In practice, the framework can supplement the more traditional, and well-established focus on IS risk management. We propose that just like risks, the level of perceived uncertainty has to be monitored and managed. To do so, the framework can serve as a IS project management tool for reflecting on one’s own and others’ behavior and for diagnosing the type(s) of uncertainty in play at a given point in time, the level of perceived uncertainty for that or those dimensions, and the appropriate management strategies.

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